REMARKS

In an Office Action mailed September 25, 2003, pending claims 1, 2 and 4-25 were rejected. The drawings filed on February 13, 2002 were accepted. In response, Applicants are herein amending claims 1, 4, 5, 7-17, added new claim 34, cancelled claim 6 and respectfully request the reconsideration and allowance of claims 1, 2, 4, 5, 7-25 and 34.

Claims 1, 2, 4, 11 and 16 were rejected under 35 U.S.C. 102(e) as being anticipated by Adkisson et al. (U.S. Patent 6,472,258). As amended herein, claim 1 and dependent claims 2, 4, 11 and 16 recite a method to form a vertical double gate semiconductor having two physically separated gate electrode regions of differing conductivity type. Adkisson et al. disclose a double gate transistor where each gate is polysilicon of the same doping. As explained in the Background section of Applicants' specification at page 2, lines 13-18, "A disadvantage with both gates constructed of polysilicon with the same type of doping is that the resulting threshold voltage of such gate structures is either around one volt or is below zero as in the case of a depletion mode device. This limited range of threshold voltage is unacceptable for modern applications...". The structure recited in claim 1 provides two gates each with a differing doping profile and therefore, the threshold voltage of the device has enhanced control over the structure taught by Adkisson et al. The two gates of Adkisson et al. are separated by silicon nitride that extends significantly above an upper surface of each gate, thereby consuming significant area of the transistor gate region. While not recited in claim 1, it should be noted that the recited gate structure has oxide and nitride, such as silicon nitride, or one of these two materials separating the two doped gate regions in a more efficient layout. Adkisson et al. do not teach or suggest opposite doping of the two gates shown therein. Additionally, the process flow taught by Adkisson et al. that requires polishing and separating of the gate polysilicon regions as shown in FIG. 1 and the subsequent formation in FIG. 2 of large silicon nitride regions would significantly restrict effective opposite doping. Applicants respectfully request the reconsideration and the withdrawal of the rejection of claims 1, 2, 4, 11 and 16 under 35 U.S.C. 102(e).

Claims 5-10 and 12-14 were rejected under 35 U.S.C. 103(a) as being unpatentable over Adkisson et al. as applied above, and further in view of Fried et al. (U.S. Publication 2003/0113970). Fried et al. disclose an asymmetric doped polysilicon gate FINFET. The

structure has a continuous single gate of gate regions 24, 26 and 28. As describe in the Background section of Applicants' specification at page 2, lines 18-25, "Others have used different doping concentrations within the same continusously connected gate material in an attempt to modify threshold voltages." However, as noted therein the continuous gate structure results in cross migration of dopants and the cross migration leads to part of the gate functioning in a depletion mode or a high threshold voltage mode. Gate region 28 of Fried et al. is counterdoped or double implanted as described at page 3, left column, last sentence of paragraph 31. Because of the cross migration of dopants in gate region 28, the double implant gate region 28 is a material that is very resistive. A resistive gate material is an undesired characteristic as it results in a gate voltage drop that causes undesired leakage current to exist and also a variation in transistor threshold voltage. As recited in all pending claims, including new claim 34, Applicants have provided an improved device structure having physically separated, i.e. two or more, gate regions of differing conductivity and that are separated by a gate structure that prevents migration of doping species between the gate regions. As amended herein each of claims 5, 7-10 and 12-14 is readily distinguishable from the teachings of Adkisson et al. and Fried et al. Further, there is no incentive to combine Adkisson et al. and Fried et al. Adkisson et al. do not teach the doping of gate material of a double gate trench transistor and Fried et al. teach the use of a physically continuous asymmetric gate having a counterdoped portion. The suggested combination to form the rejection does not suggest, much less describe the recited structure of claims 5, 7-10 and 12-14.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Adkisson as applied above, and further in view of Forbes et al. (U.S. Patent 6,414,356). Forbes et al. was cited for the proposition that it is known to anneal electrode regions before forming a metal. The anneal recited in claim 15 is one step of a significantly different process than taught or suggested by Forbes et al. Process steps, such as an angled deposition or an anneal, which themselves exist in materially different processes to obtain significantly different structures, may be readily found in the literature. However, such steps do not suggest or teach the claimed process of claim 15 which depends from claim 1. Therefore, the rejection of claim 1 on the basis of the combination of Adkisson and Forbes et al. is improper for failing to teach the recited method, at least for the reasons provided in connection with claim 1. Applicants request the withdrawal of the rejection of claim 15 for the reasons stated above.

Claims 17-25 were rejected under 35 U.S.C. 103(a) as being unpatentable over Adkisson in view of Fried (U.S. Patent Application Publication 2003/0113970 A1). Claims 17-25 differ from Adkisson at least for the same reasons as provided above in connection with claim 1, including two physically separate or noncontiguous gate regions of differing conductivity. As amended herein, claims 17-25 each recite an improved device structure having physically separated gate regions of differing conductivity and that are separated by a gate structure that prevents migration of doping species between the gate regions. The combination of Adkisson and Fried does not teach or suggest such a structure.

New claim 34, which is associated with previously elected Species II, among other identified species, is also distinguishable from the art made of record as of this communication. For example, none of the art made of record teaches or suggests physically separate and oppositely doped semiconductor portions in a double gate device having no connecting material that is counterdoped. Applicants request the reconsideration and allowance of newly presented claim 34.

Applicants respectfully request consideration of the amendments and the allowance of claims 1, 2, 4, 5, 7-25 and 34, thereby placing the application in condition for allowance. Should issues remain that might be subject to resolution through a telephonic interview, the Examiner is requested to telephone the undersigned at (512) 996-6839.

Respectfully submitted,

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